AIR TRAFFIC MANAGEMENT STRATEGY FOR 2000+

VOLUME 1

NOVEMBER 1998

Table of Contents

This page intentionally left blank

1. Introduction to the ATM Strategy for 2000+

1.1. Background

The Air Traffic Management (ATM) Strategy for the years 2000+ has been developed at the request of the Transport Ministers of the European Civil Aviation Conference (ECAC) against the background of an actual and forecast increase in European Air Traffic which will demand a quantum increase in ATM and airspace capacity. The Strategy describes the processes and measures by which the forecast demand may be satisfied, while improving aviation safety.

The ATM Strategy for 2000+ follows on from the ECAC Strategies for the 90's. It incorporates the on-going final phase of the European Air Traffic Control Harmonisation and Integration Programme (EATCHIP) and the scope of the former Airport/Air Traffic Services Interface Programme (APATSI).

1.2. How the Strategy Was Developed

At the fifth meeting of ECAC Transport Ministers (MATSE/5) in Copenhagen on 14th February 1997, Ministers adopted an Institutional Strategy for Air Traffic Management (ATM) in Europe and decided that the EUROCONTROL revised Convention, which was signe d later in 1997, would be the legal instrument for the implementation of the ECAC ATM Institutional Strategy.

In addition, the Ministers requested, for consideration at their next meeting, a proposal for a comprehensive, 'gate-to-gate' orientated ATM Strategy for the years 2000+ as a follow-up to the En-Route and Airport Strategies for the 1990s.

After consulting with the Directors General of Civil Aviation of the ECAC States, the Director General of EUROCONTROL established an ATM 2000+ Strategy Board in October 1997 to develop, and deliver by November 1998, a strategy proposal describing how the ATM network[1] in Europe should develop in the early part of the 21st Century.

The Board comprised senior managers from the States, the Air Traffic Control Service Providers, the Airport Operators, the Airspace Users, ECAC, ICAO, the European Commission, JAA, NATO, FAA, AECMA, Aircraft and ATC Equipment Manufacturers, EUROCAE, the Professional Associations and the EUROCONTROL Agency.

The Board reviewed past and present ATM studies and activities conducted both in Europe and other regions. Supported by EUROCONTROL Agency staff, and drawing on the expertise and work of the Board Members and the organisations they represented, proposed texts were then compiled and put through a comprehensive consultation process with the aviation community.

[1] The expression "ATM network" is used in the document as a generic term to refer to the seamless ATM services needed for the gate-to-gate Strategy.

The final Strategy Proposal developed by the Board falls within the framework of the ECAC Institutional Strategy and of the regional and global CNS/ATM plans being developed by ICAO.

The Strategy proposal was presented to the Director General of EUROCONTROL in late October 1998.

1.3. The Document

The Strategy Document comprises two volumes.

Volume 1 - this document - provides the basis for, and the background to, the Strategy. It describes the Overall Objective, the high-level principles and major objectives which govern the Strategy, an outline of the main lines of action to effect change, and the general management principles to be adopted.

Volume 2 contains the detailed rationale for change, and guidance on the activities which are needed to meet the Strategy objectives.

1.4. Associated Documentation

The Strategy document is supported by a related set of technical documents, including the Operational Concept Document[2]. The application of the Strategy is inter-related to the operational and functional options described in the Operational Concept Document. Both documents will need to be reviewed and revised in parallel to ensure that they remain congruent.

[2] The most recent document is the Operational Concept Document (OCD) version 1.1., dated August 1998.

2. The Need for Change and the Main New Initiatives

2.1. The Problem

EATCHIP is nearing successful conclusion. It has delivered substantial increases in capacity and, within the limits of its scope, will generate further ATM capacity improvements. The Central Flow Management Unit (CFMU) also contributes to more effective use of the airspace and airports.

However, the present ATM organisation and infrastructure have inherent limitations and will be unable to cope with the total forecast traffic increase in European[3] airspace, which is expected to result in a doubling of aircraft movements by 2015 when compared to those in 1997.

Additionally, airspace users, faced with greater competition as markets are de-regulated, are calling for more flexible and cost-effective services.

Airport congestion, already a problem at many major airports, will become a serious constraint, especially at the international hub airports serving major European cities and tourist destinations. This will adversely affect airspace capacity planning and the environment.

Although airports are the points of departure and arrival of all flights, their ATM-related operations have never been fully integrated into the overall ATM organisation. The former Airport/Air Traffic Services Interface Programme (APATSI) was aimed at providing better practices in air-side[4] operations at and around airports. In contrast, the Strategy views ATM as a network with airports and the airspace users as an integral part of the gate-to-gate environment.

Unless action is taken to produce the required additional ATM capacity and efficiency, the gap between the demand for air transport and the capacity of the ATM System may well increase to such an extent that ATM-related delays, costs, and effects on the environment will be completely unacceptable to passengers, freight carriers, airlines and societies. Aircraft operators may then find it impossible to operate as intended.

Instead of supporting the societies which it seeks to serve, aviation may become a burden.

[3] <European > and < Europe> are used to denote the ECAC and EUROCONTROL Member States, but excluding Icelandic and Oceanic airspace.

[4] <air-side> is used to denote the runways, taxiways, etc. at airports; <land-side> denotes terminal, passenger handling facilities, etc.

2.2. Main Areas for Change

2.2.1. Organisation and Use of Airspace

A major obstacle to producing more en-route capacity is that, despite the efforts of some States and the EUROCONTROL Agency, effective use of European airspace has not been achieved.

While some ECAC States have concluded cross-border airspace agreements, the present organisation of airspace, which is not sufficiently flexible, must be improved and not constrained by national boundaries. By removing the ATM constraints imposed by national boundaries, airspace capacity can be managed most effectively. The competition for airspace by different types of airspace users also calls for more responsive airspace management processes.

These processes have still to be defined and implemented in accordance with the ECAC Institutional Strategy and the revised EUROCONTROL Convention. In addition, the different applications of ATM procedures and regulations result in a lack of uniformity in the services provided.

2.2.2. Safety

Maintenance of safety levels has an effect on capacity and operational efficiency, because delays are imposed to maintain safe separation between aircraft. Using traditional ATM methods in the face of increased traffic and the public demand for improved safety levels, could result in an increasing disruption to flight schedules. If the capacity of the airspace and the number of flights are to be increased, maintenance of, or improvements to, current safety levels will require a new and rigorous approach.

2.2.3. Extending the Limits of Human Capabilities

Traditional ATC processes rely heavily on the cognitive skills of the air traffic controller, who acquires and processes data and makes decisions in real-time. These processes are based on innovations introduced in the past to manage the levels of traffic then experienced, and are now testing the limits of the people involved in their operation and the technologies which support them. Reliance on the human element alone will lead to a critical imbalance between capacity and demand within a few years.

2.2.4. ATM

Despite efforts made by States through national measures and the EATCHIP programme, ATC systems are reaching their capacity limits, particularly in the core area of Europe. In other parts of Europe, the need for more capacity is less acute but, throughout Europe, the lack of a seamless approach to en-route and airport operations prevents the optimisation of resources. Additionally, due to insufficient use of cost-benefit analysis, costs have not been

reduced and the rationalisation, which normally follows such analysis, has not occurred.

2.2.5. Management Practices

A number of international and national ATM projects have not met time, budget or performance requirements. In addition, projects have not usually been viewed as parts of an overall system.

2.3. Overview of the Strategy

2.3.1. The Challenges

In the years 2000+ European ATM must simultaneously :

Generate extra capacity to meet demand while reducing unit costs.	**Increase safety levels.**

2.3.2. Scope

The Strategy defines the guiding principles and major objectives for the establishment of a uniform ATM network - including airports - and provides for the management of all phases of flight (gate-to-gate).

2.3.3. The Relationship between the Strategy and the Operational Concept

The Strategy provides the Overall Objective and principles to be applied in meeting that objective.

The Operational Concept discusses the main operational and functional options available to realise the Overall Objective. The Strategy provides the criteria for selecting the most appropriate options, and the management principles needed for planning and practical implementation in terms of programmes and projects.

2.3.4. Main Features

The Strategy defines the path for change and identifies those measures which will deliver early, lasting benefits for the airspace users[5]. It takes account of probable changes in the aviation environment and associated technology during the next 15 to 20 years, and builds initially on the work completed or currently underway as part of the ECAC En-Route and Airport Strategies for the 1990s. This includes some major agreed programmes which will form core elements of the Strategy for the first 5 to 10 years, but which will now need to be subject to the Strategy management principles.

[5] <Airspace users> denotes all users of airspace, including State, airline, charter, other business and commercial, recreational, etc.

The Strategy is based on the need for change to be evolutionary and not revolutionary, both to ensure effective safety and project risk management, and to protect current investments in people and systems. The aim is for a safe, cost-conscious, flexible and practicable path to the future which aids decision-making, does not rely on commitment to the unknown, and will be responsive to future scenarios.

Decision-making based on collaboration and co-operation between the stakeholders is an important feature.

A major thrust of the Strategy is to achieve the objective of one uniform airspace for Europe**,** which encompasses airspace at and around airports as well as en-route. This conforms to the intent of the ECAC Institutional Strategy. Applied in conjunction with other measures, it will significantly increase the effective use of airspace and airports, and provide the maximum freedom of movement for all airspace users, together with positive cost-benefit results and environmental benefits.

The actions proposed will not bear fruit unless they are built on a strong commitment by all stakeholders at all levels, civil and military, to provide an efficient, timely, effective and binding decision-making process for airspace management and use in accordance with the Ministers' earlier decisions.

The Strategy emphasises the need for further improvements in civil-military co-ordination and co-operation to fully exploit the one airspace concept.

It recognises that full exploitation of European airspace can only be achieved if traditional Air Traffic Control (ATC) methods are replaced, in a controlled way, by new methods based on concepts which allow the balance between humans and automation to be modified, the roles and responsibilities of people to be changed, and a new division of responsibility between the ground and airborne ATM systems based on newly emerging technologies.

The Strategy ensures that, in addition to safety, economic and financial considerations are recognised as being among the main drivers which will determine the future European ATM network.

A cornerstone of the Strategy is the Systems Approach - encompassing the gate-to-gate concept. This means that the planning, operation and use of the air-side at airports, of the airspace, and of ATM, function as one composite network supported by the EUROCONTROL Organisation.

The Strategy supports the business requirement of the aircraft operators to sustain their activity and optimise the integrity and yield of their schedules.

The Strategy identifies the required ATM Research & Development (R&D) activities to support the Strategy's two major areas of development - new procedures and new technologies.

European ATM will actively contribute to the design and planning of the ICAO CNS/ATM System and adhere to the ICAO Regional Plan to meet the airspace users' requirements on a world-wide basis, and

to ensure an effective interface with neighbouring ICAO regions and adjacent States within those regions.

The success of the Strategy will depend on the commitment of all of those involved to implement the changes needed to ensure that Europe has an effective ATM network capable of meeting aviation needs well into the next Century. This commitment must be based on agreement between the parties concerned, include the necessary legal mechanisms, and be supported by the determination of the aviation industry to realise the benefits of change. All the legal dispositions of the revised EUROCONTROL Convention will be used in the decision-making process.

Likewise, timely, operationally successful and cost-effective planning and implementation of projects and programmes can be achieved only if the management process of the Strategy is followed strictly.

The revision of the EUROCONTROL Convention, and the adoption of the ECAC Institutional Strategy, make the ATM Strategy for 2000+ a vital instrument for the development of a safe, efficient, flexible and uniform European ATM network capable of responding to the demands placed on it by society and the aviation community.

2.4. New Initiatives

Key new initiatives at European level incorporated in the Strategy include :

- the management and use of the airspace of the ECAC States as a gate-to-gate continuum for ATM purposes, not constrained by national boundaries;
- enhanced uniform safety standards, practices and safety regulations;
- a regulatory framework to provide effective and timely common rules governing ATM service application and provision by all States;
- cost-effective seamless ATM services tailored to users' requirements and allied to monitored performance targets;
- cost reduction through improved operational efficiency and the optimising of the structure and organisation of service provision;
- concurrent enhancement of the capacity of air traffic control, airspace and airports as elements of a complex integrated network;
- collaborative decision-making involving all partners based on improved information management and data communications;
- an effective management structure and process to fulfil in a co-ordinated way both pan-European and local implementation needs;
- recognition of the importance of the environmental impact of aviation;
- decision-making processes and incentive options for delivering early and lasting ATM performance improvements;

- early encouragement of the effective contribution and commitment of people in all aspects of ATM as one of the key factors for change;
- measures to strengthen and further enhance civil-military co-operation.

2.5. A Balanced and Effective Solution

2.5.1. Capacity

The Strategy prescribes a new approach to solve the problems of the present and future European ATM by integrating and improving the ATM-related resources and activities of all stakeholders in an improved, performance-driven management process which will succeed only if all stakeholders fulfil their commitments to the activities decided upon to realise the Strategy.

Initial assessment of the expected benefits of the measures contained in the Strategy indicates that they should prove sufficient to meet the forecast traffic growth in the en-route airspace, provided the Strategy is implemented effectively and in good time.

The Strategy also emphasises the need for balanced development of en-route and airport capacities. It proposes ATM solutions for the best use of the available airport infrastructure, and will help to identify where shortfalls in airport capacity will occur. However, it does not contain proposals for new runways or airports, since the provision of these is a national responsibility, and the resolution of airport capacity problems rests with the individual States and/or the airport owners.

2.5.2. Costs of the Strategy

The costs of the measures set out in the Strategy cannot be determined at present. Many of the medium and longer-term operational measures proposed need to be validated to determine the extent of the capacity and efficiency gains that they will bring, in which regions they can best be deployed, and under what conditions they will offer the most benefits. Additionally, each of the major changes will need to be supported by a clear business case. The Strategy incorporates the management mechanisms needed to achieve those activities.

Nevertheless, expert opinion is that the measures set out in the Strategy offer the best practical path to the future. Doing nothing is not an option. Failure to act to improve the ATM network will quickly lead to a high level of un-accommodated traffic demand, escalating delays, and soaring costs far in excess of those expected to be associated with the Strategy proposals.

2.6. Further Development

Aviation and ATM will continue to develop beyond the time-frame of the Strategy. While the Strategy is assumed to be valid generally for the period up to 2015, it provides a strategic planning framework to progressively extend the time horizon beyond that date.

3. Future Aviation in the ECAC States

3.1. Setting the Scene

The objective of the Strategy is to ensure that European ATM is capable of providing the required services in the future. The types of service to be delivered, and how they can be provided, depend on the way that the societies served by ATM develop in general, and the influence that this has on aviation activities. The Strategy must ensure that ATM not only responds to forecast needs, but is also able to detect, and react to, different scenarios.

The assumptions used in formulating the Strategy are set out below. They describe, in broad terms, the most likely evolution of the conditions which have the greatest impact on aviation development, and which will need to be monitored.

3.2. General Conditions

The three key elements in aviation are aircraft operations, ATM and the airports. While the same general, political, economic and environmental factors apply to each of these elements, the conditions under which they operate are different.

3.2.1. Political

It is assumed that the ECAC States will remain politically stable and that, except for an enlargement of the European Union and NATO, no major political or significant strategic defence policy changes will take place. The conditions in which civil aviation develops will depend primarily on the air transport policies of the ECAC States and the European Community.

3.2.2. Public and User Perceptions of ATM

The growing importance of aviation to society results in increased expectations and demands from the public and the users. It is expected that safety, regularity, punctuality and price will be the dominating factors in this context. For ATM, this is likely to increase the pressure to provide continuous improvements in those four areas.

3.2.3. Safety

The continuing increase in the use of air transport means that even if the accident rate stays the same, the number of accidents will increase. Safety, therefore, will assume even greater importance for the viability of the aviation system, including ATM, which will seek to increase target levels of safety. ATM safety will be an essential element of the overall air transport safety process. It will use a systematic approach similar to current practice in other

technologically advanced industries, and which is already being implemented by some European States and ATM service providers.

3.2.4. Economic

In spite of the cyclic nature of economic development, it is assumed that most of the ECAC States will see positive, although not necessarily uniform, growth leading to a continuing increase in air passenger and freight demand.

Economic forecasts indicate that ECAC States should experience an average annual Gross Domestic Product (GDP) growth of 2.5% over the next ten years, and an average annual increase of approximately 4% in the number of flights during the planning period of the Strategy (2015). This scenario will result in increasing pressure on the ATM network, including air-side operations at airports, to accommodate more flights, and for the land-side infrastructure at airports to handle more passengers and freight.

While technology will bring some productivity gains, the number of people employed in aviation and related industries is expected to increase.

3.2.5. Environmental

Environmental concerns about gaseous emissions and noise will become an increasingly important political and economic issue in aviation. As aviation activity in Europe increases, the pressure on airlines, airports and ATM to increase capacity will intensify the debate on the environmental impact of aviation activities.

Aircraft noise and gaseous emissions are expected to remain the major causes for community opposition to airport construction and capacity expansion. This means that only limited improvements in the present flight procedures at and around airports, and in airport infrastructure (runways, taxi-ways, aprons and gates), can be made to enhance capacity and care of the environment.

3.2.6. Summary

It is assumed that the background for the Strategy is a steady increase in economic development in Europe, with a growing demand for safe, high quality air transport. This demand, for business and recreational flights, will affect intra-European and international services and place even greater pressure on existing major airports. Traffic will also continue to grow at regional airports, driven by congestion at the major hubs. This will generate increased environmental concerns.

3.3. Aircraft and Aircraft Operations

3.3.1. Evolution of Aircraft

Within the Strategy time-frame the operational characteristics of aircraft used in civil aviation are not expected to change significantly. Indeed, a large proportion of the present fleets will still be in use in 10 to 15 years, and although larger aircraft may be introduced into service, this will take time.

Advanced aircraft designs, such as tilt-rotor, are expected to have little impact on the overall pattern of aircraft operations within the time-frame of the Strategy. New versions of supersonic aircraft may appear, but will operate at subsonic speeds over land in the ECAC States.

Unmanned Aerial Vehicles (UAVs) may be developed and used for some civilian aerial work applications, but the regulatory, airworthiness and procedural framework for their use has still to be developed.

Cleaner, quieter and more efficient engines are predicted, but it is unlikely that their introduction will result in the need for significant changes in the design criteria for noise or emission abatement procedures.

3.3.2. General Use of Airspace

All flights use all or part of the ATM network to a greater or lesser degree. Civil commercial passenger flights are the majority users of ATM and generally fly in “controlled” airspace where extensive services are provided by ATM service suppliers. A significant number of business aircraft and some military flights also fly in this type of airspace.

Military aviation has a special need for use of controlled airspace for the operation of transport aircraft and the transfer of large numbers of combat aircraft for exercise purposes or in response to a crisis.

The number of flights using ‘controlled” airspace will increase substantially, and account for most of the expected rise in demand.

Some business, many recreational and most military aircraft make extensive use of “uncontrolled” airspace, where the range of ATM services is much less extensive. Many of these flights make only limited use of ATM, and military flights often operate under the control of their own units which co-ordinate with civil ATM.

3.3.3. Scheduled and Non-Scheduled Air Transport

Over 1.25 billion passengers per year use the world’s airlines for business and vacation travel, and well over a third of the value of the world’s manufactured exports are transported by air. European carriers account for 25% of this global aviation market.

The present hub and spoke operations of large commercial aircraft operators are expected to continue in line with the development of inter-modal transport policies, as is the increase in point-to-point operations by smaller, low-cost operators, some of whom are allied to or owned by the major airlines.

Policies governing deregulation and open skies in Europe should lead to increased competition, encouraging the introduction of more low-fare carriers and further commercial alliances between airlines. Airline yields may therefore come under increasing pressure and aircraft operators will continue to reduce costs, with more focus on the external elements such as user charges.

The high-speed rail links under development in Europe will increase the competition for passengers for journey lengths of 600 km or less, and this has been reflected in the traffic growth forecasts.

The number of aircraft in commercial operation is expected to rise. European carriers expect to increase fleets by 2.3% per year raising seat capacity by 3.3% per year. However, the overall mix of aircraft types (narrow and wide body) in commercial fleets is likely to remain the same.

3.3.4. Military Aviation

ATM is used by the military air, sea and ground forces according to the tasks set by government defence and foreign policies. This may necessitate the use of military power to protect sovereignty, and for military aircraft to take precedence over civil aviation in some circumstances.

During recent years there has been a marked reduction in the total number of military aircraft, and in military aviation activity. The situation is now stable and it is assumed that no significant changes will occur in the foreseeable future. There is now a greater emphasis on flexibility, adaptability and operations within the framework of international commitments. The resolution of future crises may be based upon the establishment of a multi-national force which will require the co-operation of forces with different aircraft, equipment and tactics that do not co-operate on a regular basis.

Common exercises are essential for the successful and safe conduct of joint peace-keeping and peace-enforcing operations. Therefore, the training of the armed forces includes a wider range of activities than before, with greater emphasis on operations in crisis situations and regional hostilities. This, the emergence of new weapons technologies, the introduction of new, more powerful and agile aircraft, and the increasing use of UAVs for military purposes, will increase the volumes of airspace needed for training and operations, although overall usage times are likely be reduced through the flexible use of airspace.

Military operations are especially vulnerable to ATM-related changes which require the carriage of additional aircraft equipment that is not essential to military tasks. Such requirements are often difficult, or even impossible, to accommodate because of space and weight limitations, and because of the extra pressures on defence budgets.

3.3.5. General Aviation

The General Aviation sector, which encompasses other commercial and business aviation activities and recreational flying, is expected to continue to grow proportionally to the economies which it serves. The same general remarks concerning the changes in the aviation environment are therefore valid when considering how economic developments will influence general aviation movements in Europe. However, the incomes of general aviation operators are much less than those of the airline and charter operators, and the costs of additional equipment required for ATM purposes could quickly outweigh any benefits that they may realise, and threaten their viability.

Business aircraft will continue to use many more airfields than the larger commercial aircraft. They also have a lower environmental impact because their operations are less frequent, and their noise impact is generally less than that of airline aircraft. There is growing awareness of the advantages of using business aircraft to improve business efficiency, and the business jet market has an annual growth rate of about 5%. Regional economic developments, and concentration of some airline activities at hub airports, should also stimulate business passenger flights in business aircraft.

Aerial work[6] in support of industrial and agricultural expansion is expected to remain a factor in support of economic activity.

Growth in recreational and sports aviation will reflect the change in the general prosperity of citizens. There will be similar expansion in flight training to meet the needs of commercial aviation. Although these activities differ commercially from airline and business flying, sufficient airspace must be provided for these operations when determining airspace requirements and regulations for 'controlled' airspace.

The increase in General Aviation will add to the demand for airspace and airport capacity. General Aviation will continue to require access to controlled airspace and airports at reasonable commercial cost, but the increased activity is likely to be centred largely on the less congested airports, and should not place undue pressure on the facilities used by airlines.

3.4. Air Traffic Management

Corporatisation or privatisation of some ATM service provision aspects will probably continue, and will be taken into account in the Strategy. A consequence is increasing competition between service providers, who will strive for greater service efficiency and better network utilisation, and to meet performance targets.

The co-existence of public and corporatised or private service providers with diverse organisational structures will accentuate the need to consider the implications of this situation in the management

[6] Aerial work includes specialised services such as agriculture, construction, photography, surveying, observation and patrol, sightseeing and aerial advertisement

of the Strategy and to better identify those aspects associated with the regulation of ATM and its operation.

The acquisition of services from commercial enterprises, such as telecommunication companies, offering common services for the provision of communications, surveillance and navigation, is expected to increase.

Traffic growth at airports, particularly in the core region of Europe, could increase the demand for airspace dedicated to operations at and around airports to the detriment of the en-route airspace. New procedures, airspace structures and technologies may lead to the re-organisation of the areas of responsibility of some ATC centres to better serve the re-designed airspace and exploit the existing infrastructure at the same time. However, it is recognised that the social and political factors involved may result in long lead times.

Optimising the use of the ATM network for the benefit of all airspace users will require greater collaboration between the various stakeholders, and may involve changes to the boundaries of responsibilities of airport operators, en-route and airport ATC, and aircraft operations centres.

Increasing use of new technology in ATM, particularly satellite technology involving many users and extended areas of application, will increase the complexity of the procedural and technical arrangements needed, and require the development of specific solutions. The scope of these arrangements is not yet clear, but will need to be addressed in due time.

3.5. Airports

Congestion is already a serious problem and a limiting factor at some airports, and many of the major international hubs are already operating at their maximum capacity, in some instances dictated by political and environmental constraints, for longer and longer periods of the day.

As traffic increases in the future, and airlines serve additional airports to satisfy the continuing growth in passenger and freight demand, congestion and its consequences will spread to airports which do not, at present, experience capacity problems. This will cause additional delays and increase the frustration and difficulties experienced by passengers, freight shippers and aircraft operators, as well as exacerbating environmental problems.

New ATM procedures, technologies and systems will be used to provide additional network capacity and to protect the environment. However, this is unlikely to obviate the need for additional airport capacity, which can only be created by new runways/airports. Additionally, the air-side capacity of airports is influenced by the capacity and efficiency of the land-side (passenger handling, access, etc.). There is also a need to establish an effective operational partnership between ATM, aircraft operators and the airports as part of the gate-to-gate approach.

The transfer to private ownership of airports is expected to continue, and will result in increasing emphasis on the non-aviation revenue and cost reduction aspects of their operations.

3.6. Eurocontrol

The membership of the EUROCONTROL Organisation is expected to widen in the coming years, as more ECAC States apply for membership, and through the accession of the European Community.

This page intentionally left blank

4. Overall Objective and Strategic Principles

4.1. Overall Objective

The overall objective of the uniform European ATM network is :

For all phases of flight, to enable the safe, economic, expeditious and orderly flow of traffic through the provision of ATM services which are adaptable and scaleable to the requirements of all users and areas of European airspace. The services shall accommodate demand, be globally inter-operable, operate to uniform principles, be environmentally sustainable and satisfy national security requirements.

4.2. Strategic Principles

To achieve the Overall Objective, certain principles shall be systematically applied throughout the European ATM network during the life-cycle of all ATM projects.

Some aspects of the principles may be quantified as measurable objectives. Other aspects may not be quantifiable, but must nevertheless provide clear guidelines.

The following Strategic Principles shall be applied :

4.2.1. ONE AIRSPACE

The Airspace of the ECAC States shall, for ATM purposes, be considered a continuum and shall not be constrained by national boundaries. The planning, operational division and use of the airspace shall reflect this principle.

4.2.2. SAFETY

Safety is of the highest priority in aviation, and ATM plays an important part in ensuring overall aviation safety. Uniform safety standards and risk management practices shall be applied systematically to the European ATM network.

Within the total aviation safety system approach, an ATM safety regulatory regime shall be established, the functions of which shall be separated from service provision at both European and national level.

ATM safety objectives shall be established and safety performance shall be monitored.

4.2.3. ECONOMY

ATM activities and services shall be economically sustainable for the users. The direct and indirect ATM-related unit costs - which include service provision, delays, flight efficiency and equipage costs - shall

decrease in the future. Economic performance can be quantified; objectives shall be established and monitored.

4.2.4. FREEDOM OF MOVEMENT AND SERVICE QUALITY

All airspace users shall have maximum operational freedom within the scope of the other principles, and shall receive services of a nature and quality which satisfy their requirements. Performance targets shall be defined and monitored.

4.2.5. SOVEREIGNTY

Every State has complete and exclusive sovereignty over the airspace above its territory in accordance with international conventions.

4.2.6. NATIONAL SECURITY AND DEFENCE REQUIREMENTS

The ATM network shall satisfy national security and national and international defence requirements.

4.2.7. ENVIRONMENT

The environmental impact of aircraft noise and gaseous emissions shall be taken into account when defining operational ATM improvements. The implementation and application of Communications, Navigation and Surveillance (CNS) and ATM measures associated with such improvements should provide environmental benefits wherever possible.

5. The Major Strategic Objectives

5.1. Definition of Objectives

It is essential to define clear strategic performance objectives for the ATM network. However, traffic levels in European airspace vary from region to region and over time, creating different problems and performance requirements. The objectives for the future network have, therefore, to be tailored to reflect regional and local differences. Trade-offs must be made between conflicting interests.

The ECAC ATM Institutional Strategy recognises the requirement for independent bodies to address the issues surrounding future safety and performance levels and set objectives and targets. The Safety Regulation Commission (SRC) and the Performance Review Commission (PRC) will monitor and propose objectives and targets for ATM performance and safety throughout the ATM network for the consideration of the EUROCONTROL Council and Assembly. The strategic objectives set out in this section should therefore be considered in that context.

Some objectives, notably Safety, Economics and Capacity, directly address the quality and performance of the ATM services delivered to airspace users. Other objectives, such as Environment, are less directly related to the primary ATM services, but directly affect future operations. Only the major strategic objectives are described below.

5.2. The Objectives

5.2.1. Safety

To improve safety levels by ensuring that the number of ATM induced accidents and serious or risk bearing incidents do not increase and, where possible, decrease.

Safety is of the highest priority in aviation. The main purpose of ATM services is to ensure the safe separation of aircraft, both in the air and on the ground, while maintaining the most efficient operational and economic conditions.

5.2.2. Economics

To reduce the direct and indirect ATM-related costs per unit of aircraft operations.

Economic considerations should be an integral part of the development, implementation, operational and cost-recovery stages to ensure prioritisation of the allocation and usage of capital and resources at each decision stage. Cost reduction and value-for-money must be essential elements for ATM. All direct costs of the service providers and indirect costs, which include the costs of delays due to ATM, flight inefficiency and on-board equipment, need to be considered. In the future, other indirect costs, such as environmental costs, may also be included.

5.2.3. Capacity

To provide sufficient capacity to accommodate the demand in typical busy hour periods without imposing significant operational, economic or environmental penalties under normal circumstances.

To enable airports to make the best use of possible capacity, as determined by the infrastructure in place (land-side and air-side), political and environmental restrictions, and the economic handling of the traffic demand.

Capacity is a complex mix of access to airports, airspace and services, predictability of schedules, flexibility of operations, flight efficiency, delay, and network effects. ATM and airspace capacity-related aspects also include controller workload, weather conditions, availability of communications, navigation and surveillance systems, and other factors. The most visible symptom of capacity shortfall is the level of delays.

5.2.4. Environment

To work with ICAO and its member States to obtain improvements in ATM, in particular the accelerated implementation of CNS/ATM concepts, procedures and systems which help to mitigate the impact of aviation on the environment.

The environmental effects of aviation are an increasingly important political, economic and social issue. One of the goals of the Strategy is to accommodate environmental considerations in an integrated and expanded European ATM network. Others are to identify and tackle environmental problems posed by traffic growth, and to progressively improve environmental performance on a network-wide basis.

5.2.5. National Security and Defence Requirements

To determine new mechanisms, criteria and structures to enhance civil-military co-operation and co-ordination.

To ensure access to airspace for military purposes through the implementation of special procedures where necessary.

ATM has to support national security in respect of the identification of flights entering a State's national territory, and Air Defence organisations have to be provided with all ATM information relevant to their task. ATM also has to support day-to-day military operations through the provision of, and access to, sufficient airspace for military needs.

The exchange of information between civil and military ATM service providers is essential for civil-military co-ordination, and can only be achieved if civil and military systems are compatible or inter-operable.

5.2.6. Uniformity

To ensure that ATM operations are compliant with ICAO CNS/ATM plans, provide a seamless service to the user at all times, and operate on the basis of uniformity throughout the ECAC area.

Uniformity embodies both the application of common ATM rules and procedures across all European airspace, and the use of common core technical functionality in the systems used. It is not an all-embracing requirement for identical equipment or systems.

Agreed required minimum levels of aircraft equipment, performance and ATM system capabilities will be matched by defined levels of service.

5.2.7. Quality

To foster, promote and enhance the use of ISO 9000 or similar recognised quality management standards in the provision of gate-to-gate ATM services.

Quality management systems promote business excellence by ensuring customer satisfaction.

5.2.8. Human Involvement and Commitment

To ensure human involvement and commitment to support the change to future ATM, so that operational, technical and support staff can operate effectively, efficiently and safely within their capabilities and obtain challenge and job satisfaction.

ATM systems are expected to remain human-centred for the foreseeable future, and people will play a key role in achieving system safety and capacity enhancements. People are, therefore, an essential element in the ability to deliver ATM services, and their co-operation and involvement in developing and effecting change is essential.

5.3. Trade-Offs

The simultaneous satisfaction of all user requirements and fulfilment of all the strategic objectives involved is unrealistic. Conflicts of interest are inevitable, typically for access to the same airspace or runway at the same time, or for the service levels required. The approach proposed in the Strategy is to make sure that the different trade-offs supported by the various classes of users are explicit, and that, wherever possible, the optimum solutions are selected for all affected airspace users.

Setting trade-off levels implies the need to achieve subtle balances between all of the relevant factors. Examples of the trade-off areas involved are:

- the costs of providing unlimited capacity versus the costs of the delays caused by an ATM capacity shortfall;

- for a given capacity level - maximising the traffic throughput by applying non-optimal flight profiles versus accommodating a smaller number of individual flights on optimal flight profiles;

- reducing system efficiency by handling complex mixed mode operations versus mandating specific levels of equipment.

6. Lines of Action to Implement the Strategy

6.1. Defining the Path for Change

The target[7] ATM operational concept describes the available operational options which are expected to be needed to satisfy the strategic objectives. The concept also proposes a new approach and lines of action to achieve the target concept.

The lines of action are directions for change, and comprise a series of complementary and stepped operational improvements in the core ATM processes. The operational improvements will need to be progressed in parallel with the on-going modification of airspace control sectors, which is currently the primary method of enhancing capacity. This re-sectorisation of airspace will continue in many areas, either as a means to provide short-term and stand-alone benefits, or as a foundation for other improvements.

6.2. The Air Traffic Management Process

6.2.1. The Core ATM Process

The lines of action focus on changing and improving the core operational processes of ATM, the services provided, and the means of application. These core processes are:

- Airspace Organisation and Management - the structure, division and categorisation of airspace, and the rules which apply;
- Flow and Capacity Management - managing the dynamic balance between capacity and demand;
- En-route & Terminal Air Traffic Control - the monitoring and separation of aircraft, traffic sequencing, and management of capacity and flexibility for en-route and terminal airspace;
- Airport Air Traffic Control - air-side traffic management, separation and sequencing of traffic on the airport and on final approach and departure, and other airport issues, including environmental impacts.

The processes will become increasingly dependent upon the efficiency of other supporting processes and services such as meteorological and aeronautical information services, within emerging system-wide information management methods.

6.2.2. Network Effects

ATM is a complex integrated network of organisations, information and processes. The weakest element adversely affects the whole system, and the lines of action and their associated changes must therefore :

[7] 'target' refers to the ideal state that would be achieved at the time horizon of the Strategy, currently 2015.

- address the weakest points in the network and give priority to improving them;
- promote those actions which provide network-wide advantages;
- ensure that equipment change and transition periods are as short as possible.

The implementation dates for changes do not always need to be identical throughout the ECAC region, but must reflect operational needs, be economically viable and follow effective implementation paths.

6.3. A New Approach to Providing ATM Services

The target operational concept embodies a new approach to the way that ATM services are provided in order to obtain network-wide benefits. The principal characteristics and their main advantages are described below.

6.3.1. Flight Management from Gate-to-Gate

Flights will be managed continuously within the ATM network throughout all phases of flight. This will improve planning and reactions to real-time events and make better use of resources, including those at airports.

6.3.2. Enhanced Flexibility and Efficiency

The trajectory of a flight will be managed to reflect the best balance that can be achieved at any moment between the aircraft operators' needs and the prevailing flight or ATM circumstances. This will enhance the efficiency of both individual flights and total fleet utilisation, while improving the management of traffic.

6.3.3. Collaborative Decision-Making

Decisions will be made by those best positioned to take them, based on the sharing of validated real-time information. This will provide the means for greater efficiencies on a network-wide and individual flight basis. Improved information management will provide a foundation for a dialogue between the various parties in real-time during all phases of flight.

6.3.4. Responsive Capacity Management to Meet Demand

A combination of flexible ATC sectors and capacity management will be applied to ensure that demand can be handled safely and efficiently with minimum delay. This will provide operational and cost efficiencies by allocating resources to satisfy variations in traffic.

6.3.5. Collaborative Airspace Management

A collaborative airspace planning and management mechanism based on the flexible use of airspace, and involving both civil and

military authorities will be established. This will ensure that airspace is managed and used as a continuum in a flexible and dynamic way across the whole ECAC region.

6.3.6. Extended Levels of Automation and Communication Support

Future operational improvements will require the support of more sophisticated computer assistance tools and human-machine interfaces able to exploit air/ground data communication, higher quality trajectory prediction data, and the exchange of data between ground units. This will increase ATC productivity and enhance safety nets.

6.4. The Operational Improvements

The operational improvements required in the core ATM process are described below.

6.4.1. Airspace Organisation and Management

The airspace of the ECAC States shall, for ATM purposes, be considered a continuum and not constrained by national boundaries.

The main objective will be to optimise the structure of the entire ECAC airspace to permit the maximum freedom of movement for all airspace users. Flexible route and airspace structures will be planned and implemented collectively to provide the most efficient and cost-effective solutions with regard to capacity, productivity and flight efficiency.

The achievement of a high overall performance of airspace organisation and management requires action at both European and national level. Progress has been achieved in some areas and several bi or multilateral agreements have been made between States. However, the collective effort remains limited and the design and management of airspace structures and routes must be further improved for the benefit of Europe as a whole.

Much more attention must be focused on this subject. In particular, the implementation of the new procedures and technologies described in this chapter may lead to a review of the airspace responsibilities of some ATC centres to improve performance, for example by creating, where suitable, large upper airspace sectors.

Reduced Vertical Separation Minima (RVSM), Flexible Use of Airspace (FUA), advances in avionics and altimetry, the development of Area Navigation (RNAV) techniques, and improved navigation systems, will provide the cornerstones for progressive improvement in the way that airspace is managed and used.

Airspace structures that are flexible and which respond dynamically in real-time to changing circumstances should be planned and implemented. The aim will be to move to a regime whereby airspace sector boundaries are adjusted dynamically to particular traffic flows and peaks in demand.

Free routes based on RNAV operations and supported by advanced ATC decision supporting tools will be implemented progressively.

Arrival and departure routes will be redesigned to de-conflict traffic flows around adjacent busy airports. This will enhance Terminal Control Area (TMA) airspace capacity and airport throughput, and improve flight efficiency by reducing route distances and delays, thus lessening the environmental impacts.

To achieve the airspace organisation and management objectives of the Strategy, a collective ECAC plan is required, supported by enhanced tools for airspace simulation, capacity and cost-benefit analysis.

6.4.2. Flow & Capacity Management

Flow and Capacity Management will be applied primarily to:

- tactical management of arrival and departure flows - since airport capacity will be the main limiting factor in the ATM network;
- residual en-route problems, peak periods and exceptional circumstances;
- management of traffic densities in support of the enhanced flexibility in airspace design and use.

Progressive improvements to flow and capacity management will be based on enhanced Central Flow Management Unit (CFMU) services. A gradual shift from managing the demand to that of managing the capacity of the ATM network and the use of ATFM tools will further enhance safety and capacity through the avoidance of potential overloads in ATC, and will improve the use of available ATC capacity.

Specifically, this will provide :

- information exchanges and collaboration between the CFMU, ATC, airspace users and airports, allowing them to make informed decisions on alternative routes;
- overall responsiveness to real-time and optimised slot allocation and routings based on the capture and integration of current traffic data;
- capacity management to optimise the ATM configuration to meet traffic demand.

In the context of longer-term co-ordination with the scheduling mechanisms, the CFMU will provide an advisory service to airports and co-ordinators to identify routes where prospective airport slot allocations have the potential to cause congestion in the en-route sectors. This CFMU service would facilitate modifications to the proposed schedules to minimise the risk of subsequent congestion and delay. This will become even more important to ensure the integrity of flight schedules and connections as aircraft operators expand their network operations, e.g. at hub airports.

6.4.3. En-Route & Terminal Air Traffic Control

Controller workload is a major constraint to capacity enhancement and increased automated support will assist controllers to handle more flights.

Safety-net tools will be used to monitor the traffic situation and trigger alarms when predictions of the evolving traffic situation indicate that safety parameters are likely to be infringed.

These support systems and activities, although not part of the ATC activity, nevertheless assist in reducing the risk of aircraft collisions. The procedures governing the use of safety nets will distinguish them from other operational tools.

In addition to the further automation of routine tasks, operational improvements will increase productivity by the application of three methods which affect controller tasks:

- the use of automated tools to assist the controller in planning and tactical decision-making and communications;
- the redistribution of control tasks within sector teams or between controllers within a control centre;
- the limited transfer of separation tasks to the cockpit in specified circumstances.

These improvements depend on the provision of accurate real-time data on aircraft position and intent, and improvements in flight data processing systems and in CNS systems, in particular data communications. They also depend on new technology for increased surveillance accuracy, air/ground communications, and navigation system performance.

Increased route flexibility allied to the limited and clearly specified transfer of separation responsibilities to the cockpit will eventually lead to the introduction of designated ‘free flight’ airspace, where aircraft will fly fuel-efficient user-preferred trajectories and separate themselves from other aircraft. The capacity gains and cost benefits associated with the transfer of separation responsibilities will be evaluated, and a safety analysis undertaken, both to verify the feasibility of ‘free flight’ operations and to define the optimum volumes of airspace that should be used to accommodate ‘free flight’ activities.

6.4.4. Airport Air Traffic Control

Improvements in the management of arriving and departing aircraft at airports will provide some gains in capacity, but need to be accompanied by better management of the air-side infrastructure.

ATM operational initiatives at airports and efficient use of the available surface movement areas and associated infrastructure will bring capacity, efficiency and environmental gains in terms of reduced airborne delay and ground waiting times, and also enhance the safety of aircraft and other traffic on the airport manoeuvring area.

New runway management tools, advanced surface movement guidance and control systems, and changes to procedures will :

- enhance runway capacity and airport operations efficiency in all weather conditions within the limits imposed by political/environmental restrictions;
- reduce ATM delays, engine emissions and noise pollution;
- improve safety by improved ground conflict detection and ground traffic guidance.

Methods for improved modelling of local airport capacity, focused on improved communications between airports and the CFMU, will be developed.

A formal local interface, such as exists at a number of airports, will be instituted between the service providers, airspace users and the airports to resolve planning and tactical issues that degrade air traffic operations but are outside the domain of ATC.

Operational and strategic co-ordination between airlines, airports and ATM will be further improved to ensure that any potentially conflicting goals of airport users and airport providers are resolved.

6.5. System-Wide Information Management

ATM will increasingly depend on system-wide information management, and on efficient, high-quality services such as Aeronautical Information Services (AIS) and aviation meteorological services (MET). ATM activities, such as trajectory prediction, sequencing and collaborative decision-making, require that all parties have the same accurate information on the operational environment and rules. Similarly, the operation of the supporting CNS services will require timely, accurate and high-integrity data.

To date, the management of different types of information has evolved independently based on sub-system and service-specific requirements. As a result of this bottom-up approach, today's ATM information systems are insufficiently integrated, resulting in organisational and institutional barriers which prevent timely use of relevant information.

Many types of information are required from a wide range of information sources. Instead of airlines, ATC units and airports gathering their own data independently it will be collected, collated, stored and distributed through a network system. This will be done by systems already in place and currently being developed in support of operational improvements.

Information sharing and collaborative decision-making, which are fundamental elements of the ATM target concept, will rely on an automated, integrated and networked digital environment.

To meet the long-term challenge, a system-wide information management strategy will be established to select and apply common information management concepts for all ATM information.

6.5.1. Requirement for Collaborative Decision-Making Applications

Collaborative decision-making relates to the need for all relevant information to be shared between the parties involved in making decisions. Decision-making follows as a normal operational process, but will be of a better quality. Operational procedures will be defined to allow a change in the decision-making structure, together with a code of conduct.

6.5.2. Aeronautical Information Services

AIS will be improved and developed within the ECAC region to provide a harmonised, co-ordinated service delivering quality assured information for all phases of flight. This will be achieved through the increased use of automation, the introduction of quality management, and the evolution of aeronautical information provision to meet the interoperability requirements of system-wide information manage-ment.

A broad range of ATM activities, such as trajectory prediction and sequencing, will increasingly depend upon all parties moving beyond current paper-based and labour-intensive information management which, with separate promulgation by each State, would limit future efficiency.

Future plans include provision for:

- common information presentation;
- common airspace environment databases;
- common amendment of aeronautical information;
- integration of AIS and MET information access;
- dynamic revision to AIS and MET information to aircraft in flight.

6.5.3. Meteorological Services

All phases of flight can be significantly affected by meteorological conditions. The safety and efficiency of air traffic relies upon the timely and accurate and up to date availability of MET information to pilots, controllers, and planners. Links between ATM and MET service providers and the users provide the means to integrate requirements and provide the full range of information needed for aviation purposes.

Improved accuracy and timeliness will facilitate flight trajectory prediction, resulting in more effective collaborative decision-making and improved efficiency of ATM and aircraft operations. Adverse weather conditions can be identified and managed more efficiently, thereby improving safety and flexibility, for example by routing aircraft around bad weather and providing more timely information on the need for diversion.

The management of aeronautical MET within the ECAC region will be progressively improved by centralised co-ordination.

6.6. Human Resource Issues

6.6.1. The Scope

Changes in ATM procedures and technology in the period covered by the Strategy will be a major human resources challenge. The successful implementation of complex systems requires a systematic approach in which all human resource issues are considered and integrated.

6.6.2. Core Issues

The two main lines of action will be to ensure:

- the timely availability of the required suitable people;
- pro-active management of human performance.

6.6.3. Timely Availability of Suitable People

The following will need to be addressed:

- recurrent analysis of operator tasks, functions and cognitive abilities to prepare for optimal human-machine task sharing;
- identification of changes to ATM job profiles as a result of new procedures and technology;
- provision of manpower via improved planning methods and data applied to all ATM staff to meet future operational and capacity demands;
- co-ordination of the recruitment, selection, training and licensing chain to maintain consistent high quality service;
- development of training programmes to involve and prepare staff for change;
- consideration of the social and motivating factors associated with transition, change and commitment.

6.6.4. Pro-Active Management

To achieve the necessary involvement and commitment to the Strategy, the following human resources criteria will be used:

- evolutionary enhancement of roles, capabilities and motivation;
- consideration of human factors issues must be part of the technology design and certification process and of the development of operating procedures, and be completed before technology is used operationally to avoid flawed human-technology interfaces which may cause operating problems and additional costs throughout the system life-cycle;
- determination of the best balance of human and machine capabilities by R&D and simulation, throughout the development and design process of new procedures and systems, will enhance their usability and acceptability.

6.7. Communications, Navigation and Surveillance Issues

6.7.1. Change and Availability Issues

The near future is likely to see the further development of information technology, based on satellite technology, mobile data-link communications and advanced computer technology.

CNS systems are key ATM functions. Each is fundamental to the safety and efficiency of air transport, and the availability of CNS systems and of inter-operability standards is critical to successful operations.

CNS is a global business in which all stakeholders must make cohesive benefit-driven technical choices backed by realistic investment plans and political commitment.

6.7.2. Challenges and Solutions

Fragmentation

The ECAC Strategies for the 90's achieved significant harmonisation and integration of ATM, but much fragmentation of systems and effort is still apparent.

CNS systems will form the backbone of the future ATM network. Successful implementation will depend on collaborative decision-making during system evolution especially in the light of the plurality of interests at all levels.

The multiplicity of choices, fragmentation and insufficient decision-making transparency result in a lack of long-term planning, or low confidence in those plans which are established. In such circumstances, Industry is not encouraged to undertake technology and product development in a timely fashion. Industrial support and confidence are a vital factor in developing the systems needed in the future.

The evolution of the CNS systems must therefore follow a benefit-driven approach. A long-term plan will be developed, laying out the transition and quantifying the benefits for both service providers and airspace users to be achieved at each step.

The rule-making process needs to be improved to help promote transparency, trust and confidence, in particular by the adoption of a European Notice of Proposed Rule-Making (ENPRM). This should be supported by a process of Hearings of Interested Parties (HIPs). Both of these measures will assist in obtaining commitment to change by the stakeholders.

Investments

The pattern of capital investment and return is a particular concern. The technical systems available today offer a variety of ways to improve communications and enhance safety. Means of ensuring that all areas of aviation are able to benefit from the choices made shall be developed to encourage investment by the airspace users, particularly the commercial aircraft operators and ATM service providers. This approach will help to achieve an optimum balance between private and public funding, and assist private investors in identifying suitable areas of opportunity.

To ensure that investments in CNS programmes help to deliver the required operational benefits, improved programme management is needed. The EUROCONTROL Organisation will place a high priority on management competence and manage the agreed common programmes from initial development to operational implementation.

European States may need to use different transition arrangements and implement systems based on local requirements, but controlled and collaborative segmentation is needed to replace the fragmented efforts of the past. Monitoring of the process is necessary to determine which functions should be centralised or de-centralised for maximum efficiency.

Frequency Spectrum

CNS is vulnerable to decisions made by organisations which are not part of the aviation industry.

CNS systems rely heavily on the availability of a suitable frequency spectrum. Competing commercial interests outside the aviation industry are acquiring increasing allocations of this valuable resource, and aviation interests have little influence over this process at present. A political initiative is needed to ensure that sufficient segments of the frequency spectrum are preserved and protected for aviation use during future frequency allocation deliberations of the International Telecommunications Union (ITU).

7. Management

7.1. Objective and Scope

The management objective is to convert the ATM Strategy for 2000+ into practical implementation actions in conformance with the strategic principles. All management actions will be focused on, and support, the Strategy objectives and associated programmes.

The guidelines for a management geared to the effective development of the future European ATM network in accordance with the Strategy are set out below.

7.2. Institutional Framework

The revised EUROCONTROL Convention, which is the legal instrument of the ECAC ATM Institutional Strategy adopted by Ministers in 1997, will provide the institutional framework for the ATM Strategy for 2000+.

7.3. Division of Responsibilities

According to the provisions of the revised EUROCONTROL Convention, responsibilities are divided as follows:

- the EUROCONTROL General Assembly[8] is responsible for defining European ATM policy (i.e. the Overall Objective and the strategic principles), and the resultant major objectives and performance targets;
- the EUROCONTROL Council is responsible for the implementation of the relevant decisions of the General Assembly, for the overall planning and consolidation to realise the major objectives, for performance monitoring and setting regulatory parameters;
- the EUROCONTROL Agency is responsible for the implementation of the required activities and, in particular, for the planning and, when decided by the Council, the implementation[9] of common projects. It is also responsible for developing proposals concerning the harmonisation of regulations, and the co-ordination of ATM Research, Development, Trials and Evaluation programmes conducted by the States;
- the airspace users and service providers are responsible for their timely and effective response to agreed plans, programmes and projects.

In addition, the EUROCONTROL Agency must initiate and co-ordinate, with all affected partners, the rule-making process which influences ATM.

[8] Under the legal instruments put in place for the transition period (pending the entry into force of the revised Convention), the major decisions are prepared by the EUROCONTROL provisional Council and taken by the EUROCONTROL Permanent Commission.
[9] Where implementation is not the responsibility of States, Service Providers and/or Airports.

7.4. Decision-Making, Commitment and Follow-up

Decisions taken at the EUROCONTROL General Assembly and Council levels are based on dispositions of the revised Convention in which the decision-making process is predicated on majority voting.

Decisions taken by the EUROCONTROL General Assembly and Council are binding on the contracting parties and the EUROCONTROL Agency. According to the provisions of Article 9 of the revised Convention contracting parties may derogate, but such derogation is subject to another review by the General Assembly within a period not exceeding one year.

For the non-EUROCONTROL ECAC States to which the Strategy will apply, a method for ensuring the rights, obligations and commitments of those States should be established.

Experience shows that a decision taken at a given time at a given level is not automatically translated into the full, timely commitment and follow-up needed at all levels in all States. To obtain commitment, a convincing case must be presented to those who are empowered to make binding decisions. Initial and continued commitment to an activity requires each step to be accompanied by evidence, including cost-benefit analysis, which motivates the airspace users and service providers to make the necessary investments.

Commitment can encompass a range of objectives, such as a general agreement on an aim (e.g. a target date), to the more focused commitment to provide specific resources. It is vital to the success of projects that the commitments made are known and accepted at all levels by the stakeholder(s) involved.

7.5. Rule-Making and Regulation

7.5.1. Common Rule-Making

Common operational concepts at the European level, particularly those involving the provision of airspace capacity to meet demand, will require definition and agreement. The successful realisation, maintenance, and continued development of a safe and efficient uniform ATM network requires all parties to fulfil the commitments which they have accepted to achieve performance objectives and implementation targets. This also requires the various stakeholders to ensure that their actions will not be delayed by logistic problems. An important mechanism to achieve strengthened commitment is through rule-making.

7.5.2. The Rule-Making Process

The rule-making process needs to be improved to help promote transparency, trust, confidence and consensus on change among all major stakeholders (national and European authorities, Service Providers, Airspace Users and Manufacturing Industry). One measure to achieve this will be the adoption of a European Notice of

Proposed Rule-Making (ENPRM) to assist in obtaining commitment to change by stakeholders.

The common European Rule-Making Process for ATM will be developed initially for programmes and projects of common interest but with a view to later extension to other related areas. This process will encompass :

- the strategic direction and the associated decisions provided by the EUROCONTROL General Assembly and Council;
- the development of proposals which may lead to rules or regulations requiring common implementation;
- notification and consultation (process of Hearings of Interested Parties) with all interested parties;
- promulgation of the final rule.

This process will be co-ordinated by the EUROCONTROL Agency and conducted within the provisions of the revised Convention, in close co-operation with Member States, Service Providers, Manufacturing Industry, Airspace Users, and ICAO, EC, JAA/EASA, EUROCAE and other aviation rule-making / drafting and standardisation bodies.

The level of uniformity achieved in European ATM will be determined by the application of common rules, ranging from general objective setting, which permits those concerned to determine the pace of implementation, to detailed provisions and standards when this approach is essential for the successful achievement of an objective. The EUROCONTROL Organisation should develop proper processes for declaring that agreed important products/systems are compliant with a standard. The scope of these proposals will be further defined.

EUROCONTROL's General Assembly and Council will exercise the power of binding decision, made possible through the revised Convention, as the final step in the rule-making process. The application of Rules by the contracting parties in a regulatory environment should be the subject of further study.

All regulatory and rule-making activities must be proportional to the objectives to be realised, be based on the revised Convention and the Strategy, and be consistent with safe, expeditious and economic operation.

7.6. Organisational Aspects and Enlarged Partnership

The transition from EATCHIP to the ATM Strategy for 2000+, and the development of the future European ATM network, necessitates a new flexible management structure for the EUROCONTROL Organisation, to support the implementation of the agreed programmes associated with the Strategy. Measures to achieve this are being developed in the EUROCONTROL Agency.

The systematic approach of the Strategy, and the variety of different stakeholders in the ATM network, demand an enhanced involvement of all stakeholders in the decision-making process.

7.6.1. Collaboration

All programmes and projects must involve collaboration between all parties who are influenced by and/or exert influence over such activity.

Agreements and memoranda of co-operation should be established by the EUROCONTROL Organisation with all parties whose decisions, activities and/or services affect the realisation of ATM programmes/projects. These will provide the platform for collaboration.

The following are the most important collaboration requirements:

Collaboration with Airspace Users

Major programmes concerning the use of the airspace must be improved. The future prevention of costly shortcomings requires a close collaboration, including clear lines of communication and the exchange of all relevant information between the EUROCONTROL Organisation, States, service providers and manufacturing industry on the one side, and airspace users on the other.

Collaboration with ATM Service Providers

Due to economic liberalisation, there has been a trend to increasing privatisation and corporatisation of ATM service provision in several States. The realisation of the objectives set out it the Strategy will affect the operation and management of ATM service providers. Although the final authority rests with the States as contracting Parties to the revised Convention, it is essential, besides the national internal co-ordination, to improve the involvement of ATM service providers in the EUROCONTROL Organisation's decision-making process.

Collaboration with Airports

Airports are an integral part of, and affect, the total ATM network. The benefit of integrating airports into the network can only be realised through the establishment of an arrangement between the EUROCONTROL Organisation and the airports, either as a community or individually, which ensures commitment by all parties to agreed ATM programmes and projects.

The EUROCONTROL Organisation should, as a matter of urgency, establish a collaboration agreement for progressing relevant ATM issues with the airport community.

Civil-Military Collaboration

The ECAC ATM Institutional Strategy and the revised Convention highlight the importance of close civil and military co-operation and co-ordination, and recognises that military authorities are airspace users, service providers and airport operators. The measures taken to enhance this co-operation by the creation of the EUROCONTROL Civil-Military Interface Standing Committee (CMIC) and a dedicated EUROCONTROL Military Expert Unit in the Agency should be further strengthened by the ratification of a Memorandum of co-operation between the EUROCONTROL Organisation and NATO.

Collaboration with Manufacturing Industry

ATM has a poor record for implementing change to time and within budget, and many major infrastructure projects have suffered delays and escalating costs. This indicates that there are fundamental problems in the development of complex ATM systems, and the relationships with equipment suppliers. Suppliers and service providers need to develop procedures for the best use of their expertise and ensure that requirements and products can rapidly converge.

In addition, the EUROCONTROL Organisation will conduct an analysis of the ATM rule-making, standardisation, operational requirement determination and contractual specification processes, and Industry's involvement in those processes, to identify past problems and effect measures to share best practice as a matter of urgency. This will help to shorten the transition periods and bring cost-benefits.

7.6.2. International Collaboration

European ATM will strengthen its contribution to the design and planning of the ICAO CNS/ATM System. European ATM will also remain aligned with ICAO Regional ATM plans, to meet the airspace users' global requirements and to both strengthen co-operation and provide an effective interface with adjacent States and ICAO regions.

Because of the particular similarity in the development, problems and solutions of the ATM of North America and Europe, and the mutual benefits to be gained, co-operation with the authorities of North America shall be strengthened.

7.7. Maintenance of a Dynamic Strategic Planning Process

The implementation and maintenance of the Strategy, regulatory issues and common policy setting, requires an agreed strategic planning process which takes account of air transport needs, technological evolution, national security and environmental constraints. The associated activities include:

- strategic intelligence and technology watch;
- collection and analysis of user requirements;
- establishment of a European capacity development plan;
- further development and validation of the Operational Concept;
- links with ICAO and other bodies to address global implications.

Work will be performed by the EUROCONTROL Organisation in conjunction with the service providers and airspace users. The Agency will co-ordinate consultation with all stakeholders before consolidating and validating proposals for submission to the EUROCONTROL Council. The EUROCONTROL General Assembly will decide high-level strategic issues. Issues and problems detected by the PRC, SRC or CIMIC which will be reported to the Council for resolution.

The time-frame of the Strategy stretches to 2015. This time-frame is not intended to signify an end to the strategic process, and future strategic planning will continue on a rolling 15 to 20 years basis.

7.8. Projects of Common Interest

The extent of the commonality adopted for ATM projects may vary considerably, and must be managed on a regional, inter-State, or single State basis according to the nature and scale of the different actions and expected benefits.

There are two main categories of projects of common interest:

- projects which may affect all ECAC States, e.g. CFMU or Central Route Charges Office (CRCO), or which involve several States working together (e.g. Maastricht UAC);
- projects aimed at the common application of elements of the ATM infrastructure (e.g. flight data processing).

The benefits of adopting a common project approach include:

- cost saving through shared research, development, trials, evaluation, procurement and life-cycle support;
- a smoother profile of expenses for individual States and Service Providers;
- wider application of agreed standards and protocols, system inter-operability and transparent interfaces;
- ensuring the requirements of all States/service providers and airspace users are balanced.

States have recognised these benefits and, through the revised Convention, have committed themselves to identifying opportunities for adopting a common project approach wherever this is feasible and beneficial. In each instance, clear processes and definitions for supporting roles and responsibilities are required for the associated decision-making process, funding and implementation.

The EUROCONTROL Organisation will analyse the possibilities of new financing mechanisms which could assist in timely implementation of common agreed projects.

7.9. Research and Development

ATM Research and Development (R&D) must focus its activities on supporting the Strategy's major areas of development concerning new procedures and new technologies, as well as the need to validate the overall system and concept and their individual components.

ATM R&D should primarily focus on providing improved ATM service, with the minimum necessary amount of CNS R&D needed to support improved ATM.

ATM R&D related activities, including their funding, should be co-ordinated and directed at European level by an R&D Strategy which supports the ATM Strategy within the framework of the revised

Convention, and takes into account the accession of the European Community to the EUROCONTROL Convention. Arrangements should be put in place for co-operation with European and international R&D activities.

The R&D Strategy should also encompass:

- clear identification of the technical and human factor issues and the efforts and time needed to solve them;
- efficient use of resources through collaborative projects;
- effective exchange of appropriate R&D information;
- involvement of Service Providers, Manufacturing Industry, Airports and/or Airspace Users from an early stage;
- validation and quantification of related economic benefits to facilitate economic analysis.

7.10. Economics and Financial Arrangements

There are two frameworks for supporting the economic objective, and some additional policies that support direct control of costs and improved efficiency of current operations.

The two frameworks are:

- a performance-driven approach which builds on existing structures and procedures in the EUROCONTROL Organisation;
- a business-driven approach where economic regulation could determine the service quality/quantity to be provided, the price charged and the business reward allowed.

Both frameworks may co-exist and the performance-driven approach can be supplemented with a business-driven approach if so decided by individual States.

The performance-driven approach should evolve through the recommendations of the PRC and the work of other EUROCONTROL bodies. The business-driven approach raises issues that require further study.

The additional policies include:

- pricing management;
- co-ordination of the use of resources;
- facilitating financing of investments.

The requisite studies, when considered in the context of the work of the PRC, will result in proposals to be put to the EUROCONTROL Council. The shortage of research in the economic field in comparison to other areas emphasises the need for such studies being given sufficient work priority within the EUROCONTROL Organisation in the early days of the Strategy.

7.11. General Guidelines

The use of the following guidelines, together with better management structures and practices, will improve the process of change:

- the technical evolution of European ATM shall take place as a controlled step-by-step change, not necessarily at the same time in all parts of the network, but always maintaining operational cohesion of the total network;
- each project must fit within the overall network, and the total life, requirements and consequences of each project must be identified and evaluated as early as possible;
- every phase of the development of the overall network and of its elements shall be monitored to ensure and maintain continuity, budget and target dates, and to provide a basis for decisions on continuation, re-direction or cut-off;
- all partners shall be involved in the process in good time;
- technical and operational solutions, resources and priorities must be determined on the basis of delivering early benefits as well as on cost and safety grounds;
- the level of sophistication must not exceed that which is necessary for meeting the relevant performance targets, and the ambitions of service providers and equipment suppliers shall reflect this need;
- within areas where common performance target levels apply, uniformity shall be applied in defining implementation objectives and the functionality and solutions for equipment, procedures and training wherever operationally or cost beneficial;
- the development and implementation of changes to equipment and/or procedures in the respective space-, air- and ground-based elements of the network shall be synchronised.

8. Acronyms, Abbreviations and Definitions

8.1. Acronyms and Abbreviations

ACC	Area Control Centre
AECMA	European Association of Aerospace Equipment Manufacturers
AIS	Aeronautical Information Services
ANS	Air Navigation Services
APATSI	Airport/Air Traffic System Interface
ASAS	Airborne Separation Assurance System
ATC	Air Traffic Control
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATS	Air Traffic Services
CFMU	Central Flow Management Unit
CIMIC	Civil-Military Interface Standing Committee
CNS	Communications, Navigation and Surveillance
CRCO	Central Routes Charges Office
EASA	European Aviation Safety Authority
EATCHIP	European Air Traffic Control Harmonisation and Integration Programme
EC	European Commission
ECAC	European Civil Aviation Conference
ENPRM	European Notice of Proposed Rule-Making
EUROCAE	European Organisation for Civil Aviation Equipment
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
FUA	Flexible Use of Airspace (Concept)
GDP	Gross Domestic Product
HIP	Hearing of Interested Parties
ICAO	International Civil Aviation Organisation
IFALPA	International Federation of Airline Pilots' Associations
ISO	International Organisation for Standardisation
ITU	International Telecommunications Union
JAA	Joint Aviation Authorities
MATSE	ECAC Transport Ministers' meeting on the Air Traffic System in Europe
MET	Meteorology
NATO	North Atlantic Treaty Organisation
OCD	Operational Concept Document
PRC	Performance Review Commission
R&D	Research and Development
RNAV	Area Navigation
RVSM	Reduced Vertical Separation Minima
SRC	Safety Regulation Commission
TMA	Terminal Control Area
UAC	Upper Airspace Area Control Centre
UAV	Unmanned Aerial Vehicle

8.2. Definitions

The following general definitions are used in this document:

Certification	Procedure by which a third party gives written assurance that a product, process or services conforms to specified requirements.
Collaborative Decision-Making	A means to enable decisions to be made by those best positioned to do so based on the timely sharing of current and validated information.
Information Management	The timely distribution of relevant, up-to-date and validated data to those who have the necessary authorisation to access it.
Gate-to-Gate	The 'gate-to-gate' scope is considered to start at the moment the user first interacts with ATM and ends with the switch-off of the engines, including also the processes of charging users for ATM services. The scope does not encompass ATM processes only.
Harmonised	Comparable levels of performance.
Integrated	Systems or procedures which are, or which appear to the end user to function as, a single entity.
Qualification process	The process of demonstrating whether an entity is capable of fulfilling specified requirements.
Regulation	The adoption, enactment and implementation of rules for the achievement of stated objectives by those party to the regulatory process.
Uniform	Without variation and appearing the same to the end user regardless of location.
Validation	Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled (usually used for internal validation of the design).
Verification	Confirmation by examination of evidence that a product, process or service fulfils specified requirements.